

# **YUKON POWER**

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**A Symposium Presented by  
The Yukon Conservation Society**

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**Foreword by: PIERRE  
BERTON**

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# INTRODUCTION

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*The Yukon Conservation Society sponsored a four-night Study Session on Yukon Power in April, 1975, in Whitehorse, Yukon. The sessions were called in immediate response to a report on power development in the Yukon by Sigma Resource Consultants Ltd. of Vancouver, which was written for Northern Canada Power Commission. Each session was composed of several seminars on subjects related to hydroelectric development.*

*It is hoped that the facts and concepts explained will be useful to an audience outside the Yukon and will contribute to a greater understanding of the problems attending power developments.*

*Criticism of the Sigma Report should not be interpreted as criticism of the professional abilities of the consultants who wrote it. It is clear that the authors were hampered by the terms of reference given them by Northern Canada Power Commission, especially regarding the estimation of future power demand and the environmental costs of development.*

*We have an obligation to seek out and consider all the facts. Our wilderness has a real capital value that must not be sold cheaply for it can not be replaced.*

## PARTICIPANTS

*Hector MacKenzie  
Daryl Scheelar  
Gordon Wagner  
Monty Alford  
Manfred Hoefs*

*Ray Kendel  
Jim Grkelitian  
Rob McCandless  
Richard Lloyd  
Doug Craig*

Yukon Conservation Society, 1975. Compiled and edited by Rob McCandless printed by The Yukon Press. ©

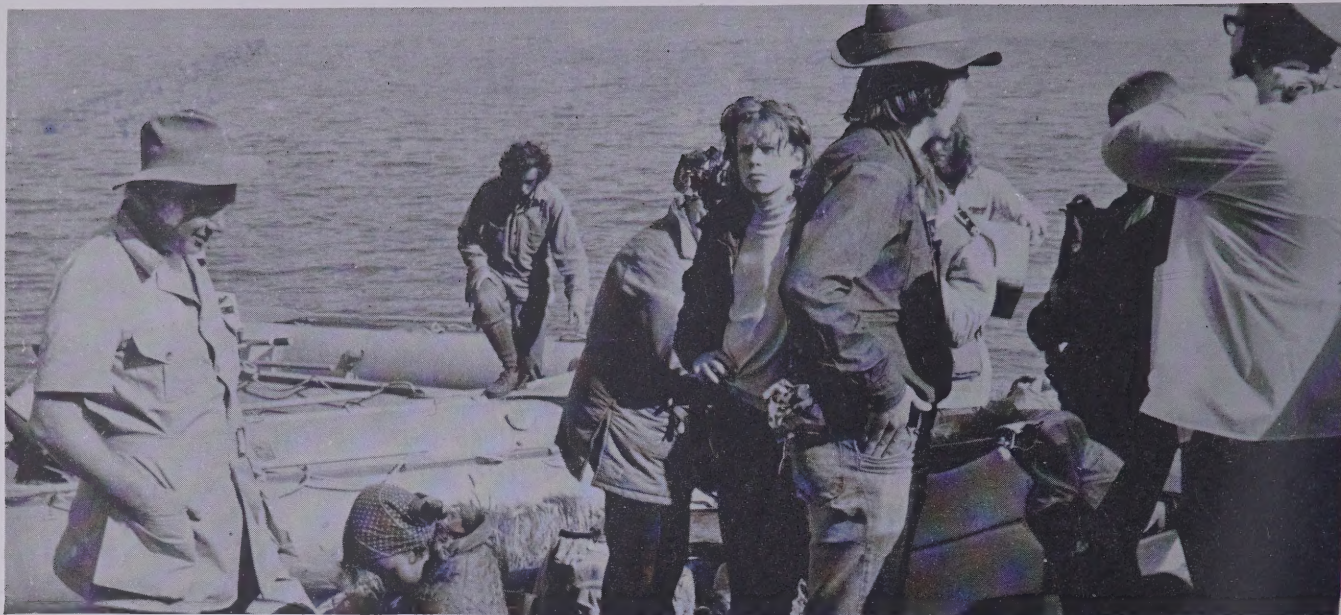
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**Foreward:**

## **PIERRE BERTON SPEAKS OUT ON YUKON POWER**

**Pierre Berton and Family**  
*On the Yukon River, 1972*

★ Whitehorse Star photo ★

In the spring of 1958, on assignment for Maclean's Magazine, I flew across the rumpled face of British Columbia, from Fort St. John to Kitimat, in an old Beaver monoplane flown by my late friend, the veteran bush pilot, Russ Baker. I remember this particular flight not only because it provided me with an eagle's eye view of some of the most beautiful country in the world but also because it brought home to me the physical havoc that power dams can wreak.

In those days, few people thought much about the environment. I didn't think much about it. The large American-owned corporations who were systematically developing our country didn't think much about it. None of the governments -- certainly not the government of B.C. -- thought much about it. It was only when I had my first glimpse of Tweedsmuir Park from the air that I was forced to think about it and to change my attitude to the north country and to mining and power developments. For this beautiful natural park in the hinterland of British Columbia was literally raped by the power interests with the active connivance of the Province of British Columbia and scarcely a whimper of protest from the mass of the public. Here is what I wrote in Maclean's at that time:

*"It is a distressing experience to fly across the daisy chain of lakes that supplies the storage water for the power development that produced Kitimat. They describe an enormous ellipse, one hundred miles long and fifty miles across, in a country so enchanting that it was set aside twenty years ago as a provincial park. It was the largest scenic park in Canada and Lady Tweedsmuir, for whose husband it was named, thought one of its lakes the most beautiful she had ever seen. Alexander Mackenzie's historic trail to the Pacific led through it, to the foot of the Rainbow Mountains, whose odd red craters caused the explorer to write that fire seemed to have passed over the rocks.*

*"But Tweedsmuir Park has paid the price of progress. Its white sand beaches are gone and from the air each lake seems bordered by a ragged line of decaying brown. For hundreds of yards and in some places for as much as two miles a tangle of fallen timber, gnarled roots, deadfalls, rotting branches, floating snags and gaunt*



*spars, stretches out into the water. The moose on their migrations, can no longer reach the shore, nor can the sportsman.*

*"In vain the naturalists protested the rape of these lakes ... In 1955 the final chapter in the tragedy was written when Tweedsmuir Park was destroyed with a pen stroke. A provincial order-in-council cut its size by one-third, rejecting the flooded area as "no longer suitable for park purposes." Without those lakes the park is as dead as Mackenzie himself."*

When I drifted down the Yukon river with my family, from Lake Bennett to Dawson City in the summer of 1972, I thought once again of power development and the lesson of Tweedsmuir Park. The lesson surely is: go slow. And that is the lesson that is preached in the pages that follow.

It is quite clear from the criticisms levelled here against the Sigma Report on Yukon Power Development that we do not yet have enough information to commit ourselves to any hydro-electric dam on the Yukon or on its tributary rivers. In fact, it's not even certain that we need that dam. We simply don't know enough about the resources that will be damaged and we haven't given any real thought to the future of the Yukon Territory. The field studies are inadequate, the value of game lost has been under-estimated, there are errors in the fisheries' estimates, there seems to have been a disinclination to use available forest studies and there are unprovable assumptions about population growth. All this is clear from the criticisms levelled by experts at the Study Session on Yukon Power in the spring of 1975.

Throughout these criticisms, two vital truths emerge: First, the research has been inadequate in almost all spheres. Second, **the value of the environment has been**

**neglected.** I emphasize this last point because to me it is the most important one. Until very recently, wilderness was wilderness -- something without intrinsic value, to be "tamed" or exploited, turned into dollars, made to produce jobs (mainly for Outsiders). The emphasis on expediency -- on the need to provide jobs, no matter how temporary -- has always been at the root of northern development philosophy. I have seen the tragic residue of that philosophy all across the Canadian north, from the Alaskan border to the fiords of Baffin Island in the form of ghost towns, abandoned machinery, old, grass-covered roads, rotting buildings, piles of junk and, worst of all, the saddening degradation of the native population.

It may well be, and indeed I am one who is convinced of this, that the untrammelled wilderness itself is the most valuable asset the Yukon has. I believe that before the end of this century, it will be beyond price. As the world grows more crowded, the cities more smoky and populous, as the available open spaces constrict, then the broad horizons of the North are going to take on new significance. Canada may well be one of the last industrial nations to enjoy the luxury of this untouched open space.

It is this aspect of the Territory that has been neglected by the engineering minds who produced the Sigma Report. They have not understood that certain resources are renewable and that certain ones are not. Smelters which gobble hydro power last only as long as the metal beneath the ground. But what is **above** the ground -- the trees, lakes and rivers -- can be husbanded and renewed more easily than any farm. Turned into mudfields by acres of backed-up water they cease to have any value; indeed, the opposite becomes true. No longer an asset, they become a liability -- an ugly scar on the landscape, like that park in British Columbia which was drowned by the aluminum interests. This we must all understand before we take any further action to dam the precious waters of the Yukon Territory.



# **Hector MacKenzie (Yukon Conservation Society) on the Sigma Re-port**

The Sigma Report titled **The Development of Power in the Yukon** was written by Sigma Resource Consultants Ltd. and released in late March 1975. It is in four volumes comprising the main report and three appendices. Sigma Resource Consultants contracted with Northern Canada in June 1974 to assist the Commission's planning process for the next decade. The consultants prepared the report as Phase One of a three phase program. Its objectives were to "set out an inventory of available energy sources and to select the more promising alternatives for meeting future loads." To be included was "an analysis of the growth of the demand for power with projections of the demand to 1990."

In December 1974 Sigma assisted NCPC in holding public hearings or informational meetings at many Yukon communities. The theme of the meetings as set out on the informational brochure was "Come and Participate - Make your Choice" meaning as it turned out, choose between one of four proposed dam sites.

The consultants discuss projected electrical demand into two broad cases depending on whether or not a smelter is planned. Each case is further broken down to several other alternatives depending upon future mining loads, population growth, demand for electrical space heat and combinations of these. To meet these estimates of demand the consultants consider various means of producing electricity and settle in favour of hydro development. Thermal power is not considered because of their estimate of the costs of thermal power and the lack of information on coal reserves in the Yukon. Various hydro plants are proposed in the report to meet the load projections with the consultant then selecting the leading schemes on the basis of estimated construction costs only. Wildlife and environmental mitigation costs are not included in the selection of a leading site.

Sigma Resource Consultants Ltd. include public informational meetings in the planning process with the next meeting tentatively set for May 1975 (These meetings were not held. *ed.*). This is probably in response to the recommendations of the Science Council of Canada regarding decisions on projects of this nature. However, no funds have been allotted to the 'public' to prepare for these meetings. Consequently they are of questionable value.

## **Daryl Scheelar (Yukon Electrical Company) on Electrical Power**

Electricity is obtained from generators that are turned by various prime movers such as steam turbines in thermal or nuclear plants, water turbines in a hydroelectric plant or by other means such as diesel engines. Generators consist of moving coils of wire in a magnetic field in such a way that there is a difference in electrical potential between the ends of the coils. The potential difference can be connected by other wires to an electrical load such as a lamp or a heater or an electric motor. Electricity is measured by describing the pressure or potential difference as voltage and by describing the amount or flow of electricity as amperes. Electricity is of

two kinds, direct current such as is obtained from a battery and alternating current such as is used in the ordinary home. In alternating current the generator causes the electricity to change its direction of flow first one way then the other many times in a second. In North America the frequency used is 60 'cycles' per second. Direct current flows in only one direction and has limited applications.

Electricity as discussed in electrical utilities is measured in watts or watt-hours as the basic unit, with the prefixes 'kilo' meaning 1000 and 'mega' meaning 1,000,000. A watt - or a kilowatt or megawatt - means the electrical unit of power, or rate of doing work. It is equivalent in its nature to horsepower in that a force (a volt) moves something (an ampere) in one second. A kilowatt of power is equal to about one and one half horse power. The power capacity of a big power dam is generally given in megawatts. The Whitehorse Rapids plant has a capacity at present of 20 megawatts. This is roughly equivalent to 27,000 horsepower. Electrical energy in electrical utilities is measured in kilowatt hours, meaning the amount of electrical power used in one hour. This is how electricity used in the ordinary home is measured and paid for.

## **Gordon Wagner (Yukon Electrical Company) on Electrical Rates**

Electrical energy is sold under two broad classes of rates, depending on the manner of use of the electricity. The average home has a meter rate system in which the charges for electric service are based solely on the quantity of energy used during the billing period. In Whitehorse there is a minimum charge which is made to all customers regardless of the amount used up to a certain minimum. This pays for the costs of bookkeeping and the maintenance of the wires and poles. Beyond the minimum a step rate is charged, so many dollars for so many kilowatt-hours, that decreases as more electricity is used in the billing period. Thus a kilowatt-hour of energy costs more to a person who uses little energy than to someone who uses a lot of energy. Homes with electric heat have a ballooning rate in that the rate for energy increases at the upper limit, this is because the cost of service to that house is greater than for the ordinary home. Commercial users are billed under a straight line rate. The price charged per kilowatt hour continues to drop as more energy is used.

There is a second method of billing for electrical service in addition to the meter rate system described above. This is a demand rate system. The customer pays a flat rate per billing period according to the kind of installation of energy-using equipment. If the customer needs a lot of electrical current for only a short time, the wires to that customer have to be large enough to carry the load within safety limits. But since the customer may need that power surge for only a short time, the metered energy consumption is relatively low. The cost of the extra wire and so on must be paid for by the demand rate, otherwise the other customers will in effect, subsidize the special user.\*





### **Suburb of Whitehorse, Yukon, in winter**

*Peak power demand occurs in January, the coldest month. The problem will be made more acute by the increasing use of electricity to heat homes.*

★ Yukon Territorial Government photo ★

The cost of electrical energy is generally higher to commercial users than to ordinary homes. This is because their needs do not coincide with the peak loads, and because their costs of power are a business cost and therefore tax-deductible. Homeowners pay for their power with taxed dollars. The system of rebates on electricity bills in use in the Yukon is based on this difference. Yukon Electrical as a private company pays income tax on its earnings. These tax monies are pooled by the Yukon Govern-

ment and allotted to Yukon Electric's customers as a rebate. The rebates are an approach to equalizing energy costs throughout the Yukon.

*\* Ed. note: Spokesmen at Yukon Electrical have implied that the Anvil Mine is not billed in the ordinary fashion by NCPC for the energy it uses in the normal demand and metered methods. The terms of the sales contract are unpublished and unavailable. If no demand billing system is used, other NCPC customers may be in effect subsidizing the cost of providing power to Anvil.*



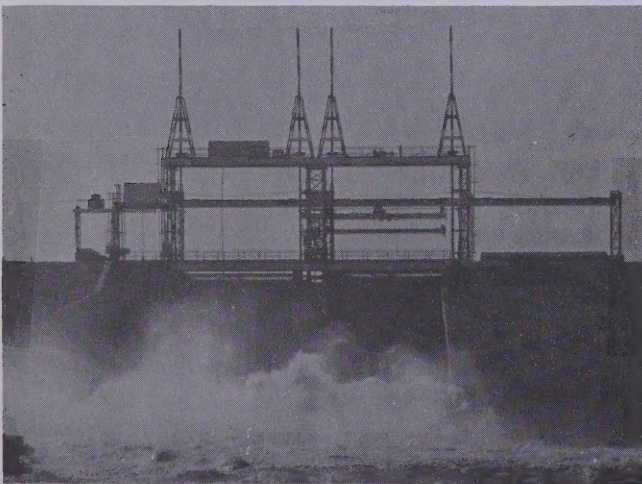
## Monty Alford (Water Surveys of Canada) on Stream Power

The Water Survey of Canada maintains some 5300 survey sites in Canada of which 78 are maintained out of the Whitehorse office of the Survey. Of this 78, about half are in the Yukon, the rest being in Northern British Columbia. Different kinds of measurements are made at each site such as water level, water flow, suspended sediment and samples are taken for water quality. Measurements are made seven or eight times a year at each site. The data is not used solely by hydroelectric engineers. Daily discharges are published annually in table form and are plotted in various kinds of hydrographs that show how the water in the stream varies according to time or some other variable.

Hydroelectric engineers are concerned with two factors in designing a dam. The first is the size of the greatest flow during floods which the spillway has to be designed to accommodate. The second factor is the lowest flow expected which determines the height of the dam. Firm flow means that the natural or lowest flow plus the amount that can be stored behind a dam and released slowly over time. This firm flow is the measure of water power that can be turned into year-round steady electrical energy by the generators.

Yukon rivers are characterized by great seasonal variation in flow. The Yukon River's lowest flow in March or April is only one fifteenth of the highest flow in July. On the Peel River the difference is nearly 400 times. These facts have an important bearing on dam design in that a Yukon dam must have a large storage capacity in order to produce a steady amount of energy. The dam must "smooth the hydrograph" and increase the firm flow. For a river like the Pelly, where the flood is 70 times greater than the minimum flow, smoothing will require a large drawdown, or difference between high and low levels in the reservoir.

There is adequate hydrological data on the Yukon and Pelly Rivers to construct dams in that the variations are predictable. For other rivers such as the Tatshenshini it would be most difficult to predict flows because years of data collection are needed. Consequently Sigma's figures on the Tatshenshini River are very much open to question.



### Whitehorse Rapids Hydro Plant

*The capacity of this plant will be increased from 20 to 40 megawatts in 1977 to use more of the high summer flows of the Yukon River.*

★ Fred Stewart photo ★

## Edo Nyland (D.I.A.N.D. Forestry Division ( on Forestry

The Sigma Report did not appear to use the studies available on Yukon forests. There is good documentation on the forests of the Pelly and MacMillan Rivers and older studies of the Liard and Nisutlin forests. Of the 208,000 square miles in the Yukon, about 128,000 can be considered forest and of that 35,000 square miles are in merchantable timber for either sawlogs or pulp. There are sufficient timber resources to operate 2-500 tons per day Kraft pulp mills. The present cut of timber in the Yukon is about 15 million board feet (MBF) out of a maximum allowable cut of 100 MBF.

The Yukon's merchantable timber resources are divided into the Liard basin (59%), the Teslin-Nisutlin basin (16%) and the Pelly basin (17%). The Pelly valley contains about 160 MBF of good saw timber (8" plus) and 120 MBF of pulpwood. The Pelly valley is the most productive of all the regions considered for flooding. Inventory of the Yukon's forests is continuing through the use of remote sensing methods. However, enough data is available to assign values to forests lost through flooding.

## Manfred Hoefs (Yukon Game Branch) on Wildlife Resources

There was a reluctance by the Game Branch to participate in the seminars on Yukon power because of a lack of comprehensive information on Yukon wildlife and because of a possible conflict with any policy of the Yukon Territorial government towards power development. However, the Branch decided to participate after reading the Sigma Report in order to point out "several serious errors and omissions" in the report with regard to wildlife. It is emphasized that the consultants had inadequate field studies and a lack of research into publications available on Yukon wildlife. The consultants have consistently underestimated the economic value of Yukon game by ignoring some activities such as trapping and making errors in game populations. However, the Branch agrees with the consultants' comments regarding the effects of hydro development on wildlife.

The effects of a large reservoir are loss of habitat for aquatic fur bearers, loss of winter range for ungulate species such as moose, barrier effects to seasonal migrations and loss of wildfowl areas. These effects to seasonal migrations and loss of wildfowl areas. These effects will extend beyond the area flooded in that certain animals spend only part of a year in the valley bottoms. For example the winter range of moose is only one tenth of the area of the summer range. The loss of these animals through flooding will affect the ecological balance in adjacent areas. Other effects result from the operation of the dam with the unnatural fluctuations in the reservoir and the river, and interference with animal migration by power lines and related works such as roads and camps.

The Game Branch recommends that detailed studies are needed to assess the effects of any dam. Knowledge is inadequate at present, especially as compared to Alaska and British Columbia. A study would require a small staff for one year and at least \$50,000 in helicopter costs alone. Studies of this kind should be done by two parties, one from government and one from outside consultants. Of



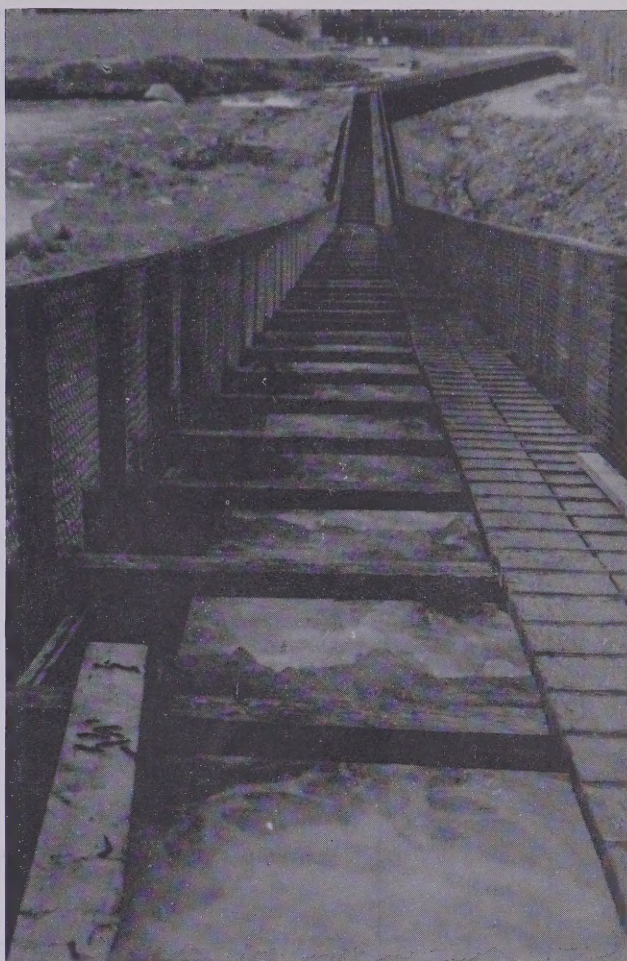
the proposed sites the Branch says that the Hoole Canyon site is the least damaging in environmental effects while the Stewart River sites would be the worst.\*

*\*Ed. note: The excellent reporting of this seminar by the Whitehorse Star of May 2, 1975 is acknowledged.*

## Ray Kendel (Fisheries Protection Service) on Fisheries

The Sigma Report gives little specific information on fisheries and deals mainly in generalities. It has errors in referring to whitefish populations. It omitted the facts that the Mayo River chinook run was eliminated by the Mayo hydro plant in 1952 and that the upper Yukon salmon run at its present rate of decline may be eliminated by 1985. The discussion of fisheries values for commercial sport and subsistence fishing is inadequate. A proper assessment of the value of fisheries may take from two to seven years to complete depending on the project site. After this was done more inventory and consultation would be needed during dam construction for fisheries mitigation, since damage can be minimized by proper engineering.

The hazards to fish from a power dam come from the complete change in the flow regime and the change from a river to a lake environment. During construction the conferrdam and diversion will prevent migrations. At the Whitehorse plant during construction only one third of the run was saved by netting the fish below the dam. After the dam is built, the fish ladders may not be enough to save the run. Once the fish reach the reservoir they lose their sense of direction and may not find the channel and current from upstream. If the fish are successful in spawning, the returning fry may not survive the passage through the dam because of sudden changes in temperature and pressure. These effects can be minimized by improved fish ladders and bypass screens, different spillway designs and hatcheries. The river flow is altered by a dam so that erosion takes place along the banks with the resulting loss of food supplies and habitat. The margins of a reservoir are unproductive due to continual wetting and drying and in the long run cause a decline in fish population.



### Whitehorse Rapids Fish Ladder

*In spite of this ladder, the upper Yukon salmon run may be eliminated by 1985.*

★ Yukon Territorial Government photo ★

### Moose in wetlands

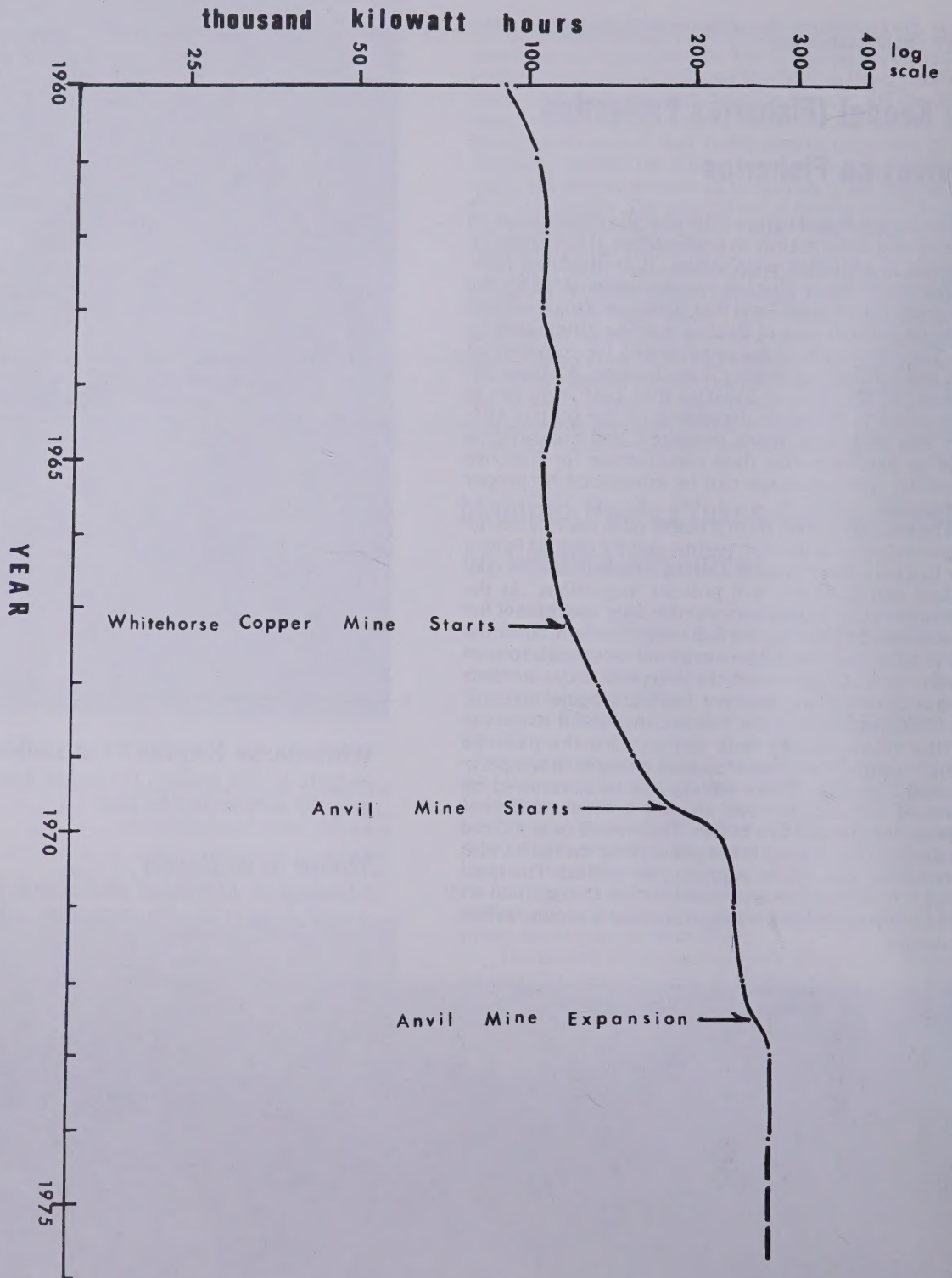
*Flooding or unnatural fluctuation in water levels can destroy critically important wildlife habitat.*

★ Yukon Territorial Government photo ★





# YUKON ENERGY DEMAND.



Source: Statistics Canada Cat. 57-001

Figure 1



## Rob McCandless (Yukon Conservation Society) on Power Demand

The Yukon has experienced a rapid growth in electrical power demand in recent years that is a result of mining activity. In order to understand this growth it will be necessary to refer to a graph of power demand for the Yukon. A graph is a means of showing how one thing varies with respect to another thing. In Figure 1, one scale is energy in kilowatt hours per year. The other scale is the year. The plotting of these points year by year from 1960 to 1974 will show how our needs have increased.

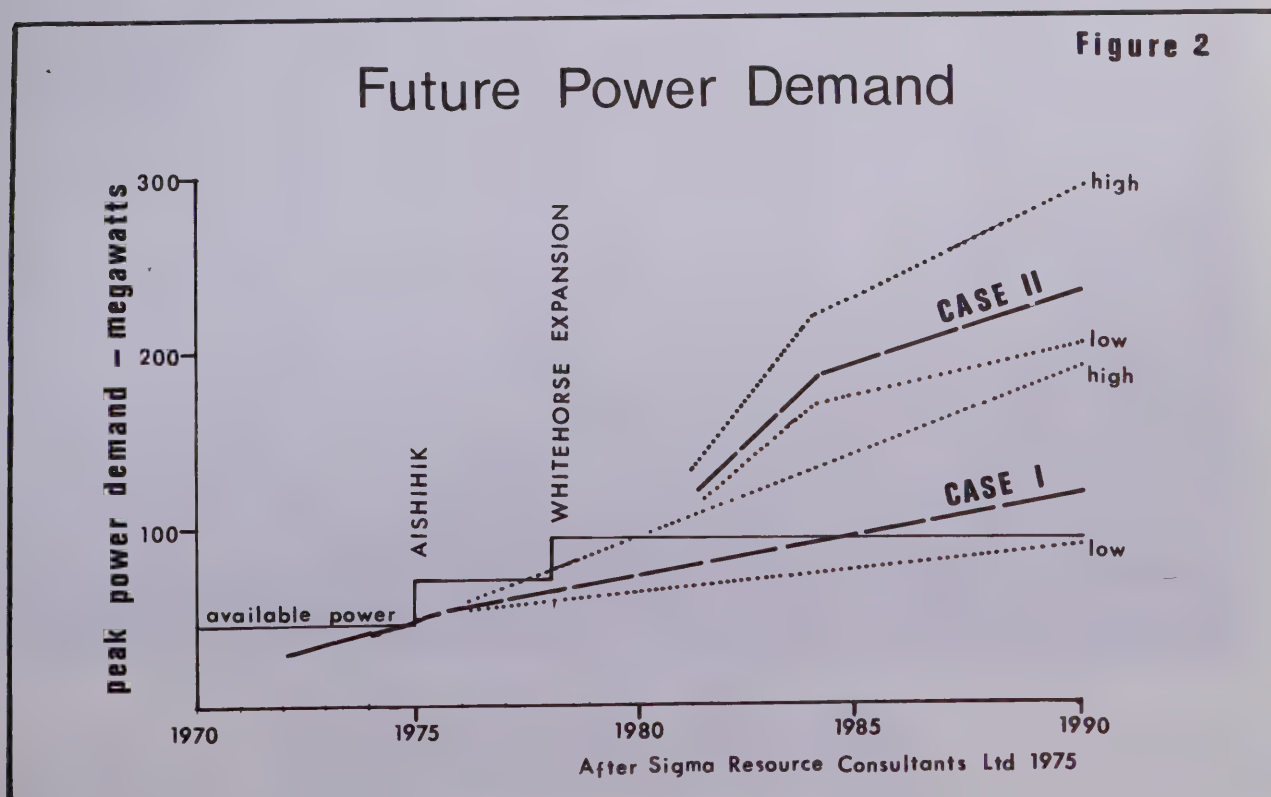
From 1960 to 1966 there was almost no growth in energy needs. In 1967 New Imperial Mines started production and the demand for that year was slightly higher. In 1968 the mine had a full year of production so the demand was pushed upwards again. In 1969 Anvil started production giving another increase. The most dramatic increase came between 1969 and 1970 as Anvil began full production. From 1970 to 1972 growth is slight. However, in 1973 and 1974 Anvil increased its rate of production and used a correspondingly larger amount of power. During all this time the population grew by only 5% per year. The growth in power demand between 1967 and 1974 is due almost entirely to mining. If we are told we are short of power it is because the mines are using everything we give them.

There has been an increase in population in the Yukon between 1966 and 1974 and there has also been a growth in power used per person. Probably this means that the people moving into the Yukon to work in the new mines have moved into new, electric-intensive homes. For the aver-

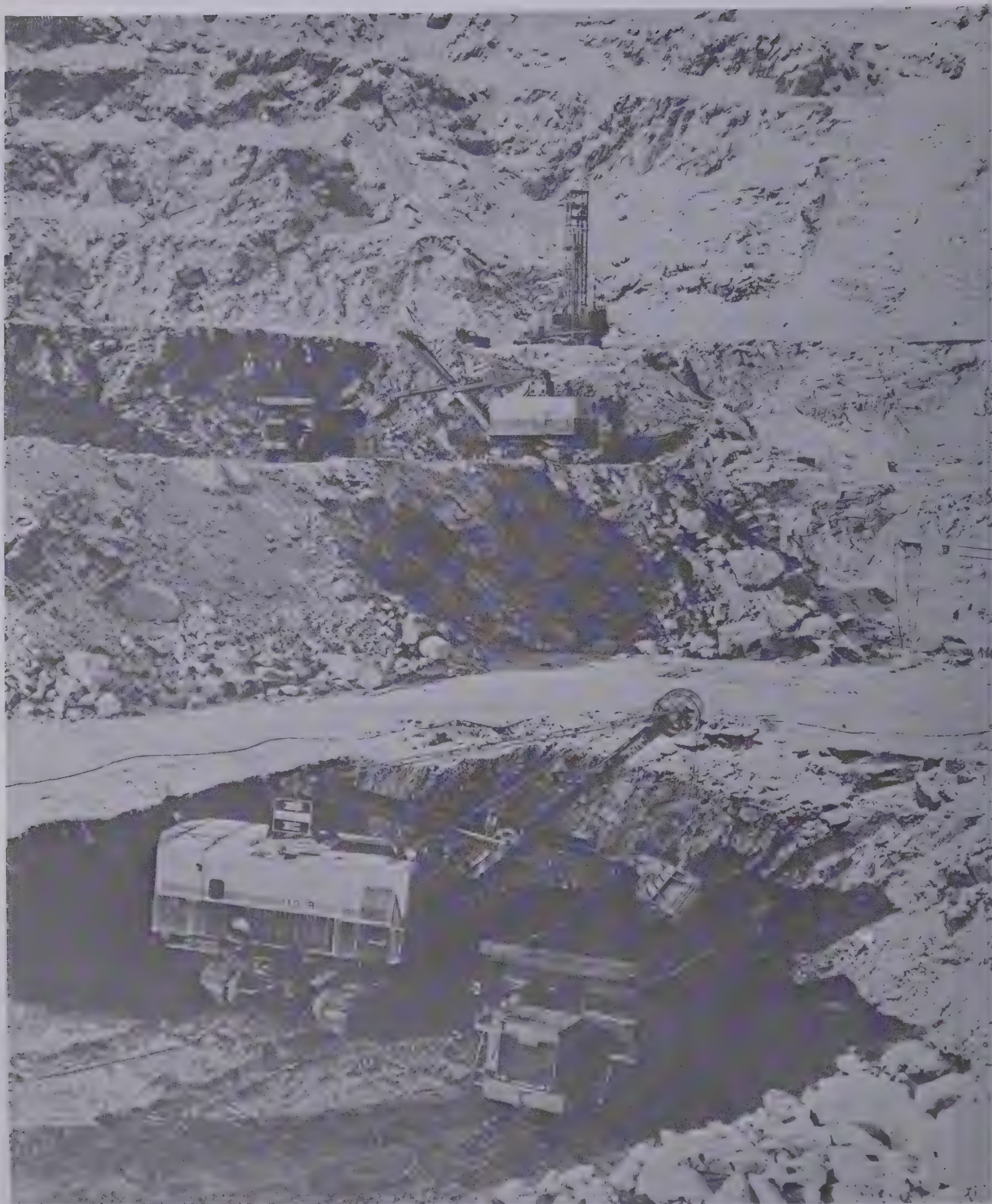
age longtime Yukoner, power use has not increased.

Sigma Resource Consultants have presented their estimates of the Yukon's future power needs. Their estimates are in two divisions, Case 1 and 2 as shown in Figure 2. Case 1 assumes no major user of power such as a smelter while Case 2 assumes a smelter. Within each case are other estimates of high or low rates of mining or population growth. Figure 2 shows the present and future capacity of the Yukon power system to meet demands. It is apparent that **by Sigma's estimates** the Yukon will need a new power source by 1979.

The estimates in Figure 2 are not realistic for three different reasons. Sigma assumes first of all that new mines will appear at the same rate as the past 8 years, that NCPC will provide the power for these mines and that none of the operating mines will cease production. Secondly Sigma assumes that the Yukon population will continue to grow at a fast rate and that new homes will be heated mostly by electricity. Thirdly, Sigma assumes that a smelter is a distinct possibility. These estimates are faulty because they leave out the Yukon's boom and bust mining history. We cannot be sure that the population will grow at such a rate. Finally all Yukoners are aware that a smelter is a highly speculative and 'political' matter. We can be sure that we have lots of power to meet our needs for the present and the future - if we insist that NCPC ceases to provide power for new mines.







### **Anvil Mine, Yukon**

*These power shovels are electric. Each one draws enough power to supply a town the size of Dawson City.*

★ Yukon Territorial Government photo ★



## Richard Lloyd (Yukon Conservation Society) on Hydro Sites

Before discussing the proposed hydro sites we should understand that the estimates of future demand are the key to the decision about a dam. Sigma Resource Consultants have shown that by their estimates a dam is needed - but they didn't say which dam on what river. Their methodology is biased because they were not asked by NCPC to include environmental costs in their recommendations. The Yukon is a place where hydro power costs much more in terms of area flooded than other places. Yet Sigma's recommendations concentrate only on the engineering aspects of hydroelectric development.

The report discusses about 100 proposed hydro sites on various Yukon rivers. They are ranked in levels from 1 to 6 according to their estimated construction and engineering costs. There are only marginal differences between the sites in terms of dollars per kilowatt of capacity.

If objections are made to one site because of environmental damage, another site is readily available. Eventually through a process of attrition NCPC will obtain its dam.

All Yukoners should have a clear picture of the damage that could be done by a dam. Yukon rivers flow through gently sloping, wide valleys. These valleys are essential to the wildlife. The rivers have a great seasonal variation in flow. This means that the reservoirs behind any dam would not have a fixed shoreline like a lake. It will move up and down through many tens of feet. This fluctuation is called 'drawdown'.

For a big dam on a river like the Pelly, drawdown will mean many square miles of lifeless mud will be uncovered every spring. When damage like this is considered, it is too high a price to pay just to sell power to a mine

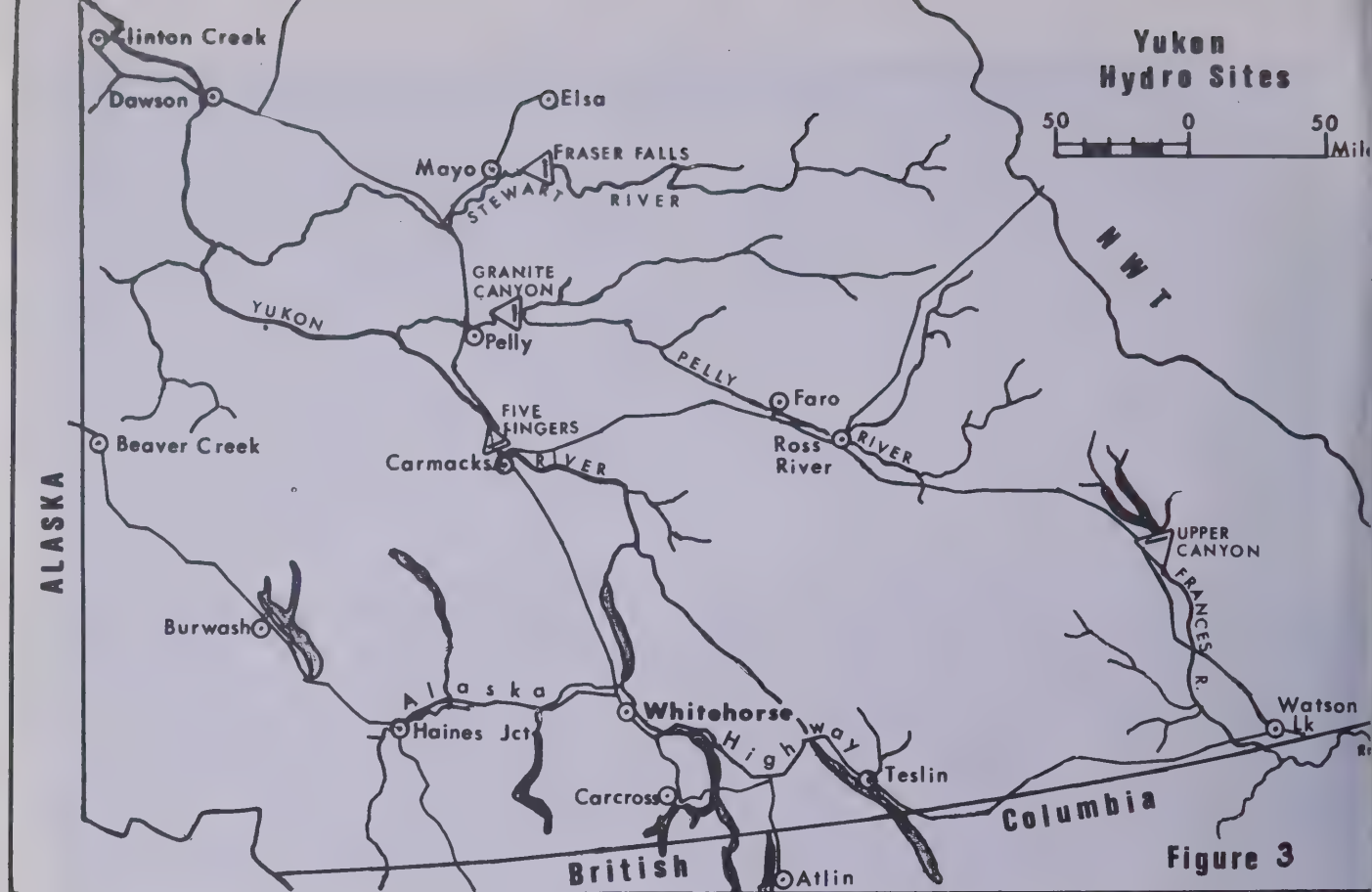


### Five Finger Rapids, Yukon River

*This proposed dams site may be the least damaging to the environment, but it is one of the best known locations on the river, having great scenic and historic value.*

★ Yukon Territorial Government photo





## Jim Erkiletian on Economics of Hydro Development

Engineering studies on the feasibility of hydroelectric development have always given short treatment to a complete economic analysis of the plant and its effects. Typically only 1/2% of the total cost has been spent on economic study. However, economists are becoming aware of arguments that show that the environment has a value with respect to the benefits of development. These values can show that the development is simply uneconomic. For example a study complete in 1967 on the proposed Ramparts Project in central Alaska on the Yukon River showed that the costs of wildlife mitigation would be 34% of the capital cost of the project and 61% of the estimated operating costs. This meant that the wildlife costs would be 40% of the 'bus bar' costs of Ramparts power! For this reason and others the U.S. Dept. of the Interior shelved the proposal.

A development such as a power dam permanently alters a portion of the environment. It is converted into a product electricity - which satisfies the needs of industries that produce goods. If the environment is left unaltered it will continue to provide the recreation and other uses as before. Development of the resource through a dam has costs which increase over time because the resource is permanently altered. The environment cannot be reproduced while electricity can be obtained from other sources. There is a growing awareness that wilderness areas are increasing in value each year because the population demand on those areas is increasing. On the other hand as the demand for lead and zinc increases, more lead and zinc is found. Resources of lead and zinc - or of electrical energy supply needed to mine that lead and zinc - can

increase as the demand increases. But the wilderness cannot increase. Technological advances will help us to get the power we will need in the future, but they won't help us to replace a drowned valley.

Benefit cost analysis is a tally sheet method of weighing the benefits of development and non-development against the costs of development or non-development. Thus the benefits over time of having electric power can be matched with the costs of loss of the wilderness resource. This approach has been used for many years in decision making about hydro development. It has several shortcomings. The first is that present day values of a wilderness resource are difficult to determine without regarding much more than the resource affected. For example the Yukon tourists industry as a whole may decline if a large dam is built. Secondly today's values of a wilderness resource are certain to increase dramatically in the future as the demand on them increases. These future values cannot be determined with any certainty. Finally the total impact of the development on the local economy has to be evaluated.

A power dam will produce a short term benefit in employment, but no other benefits. All the money for the plant and equipment would be spent 'Outside'. A thermal plant using coal would have a much greater benefit because the jobs for mining coal and plant operation would continue for a much longer period, and local suppliers could be used to a greater extent. There are other methods besides benefit cost analysis that give a better picture of the effects of wilderness resource development. More time and money is needed for the economic analysis of another power plant in the Yukon.



## Doug Craig (D.I.A.N.D. Resident Geologist) on Coal

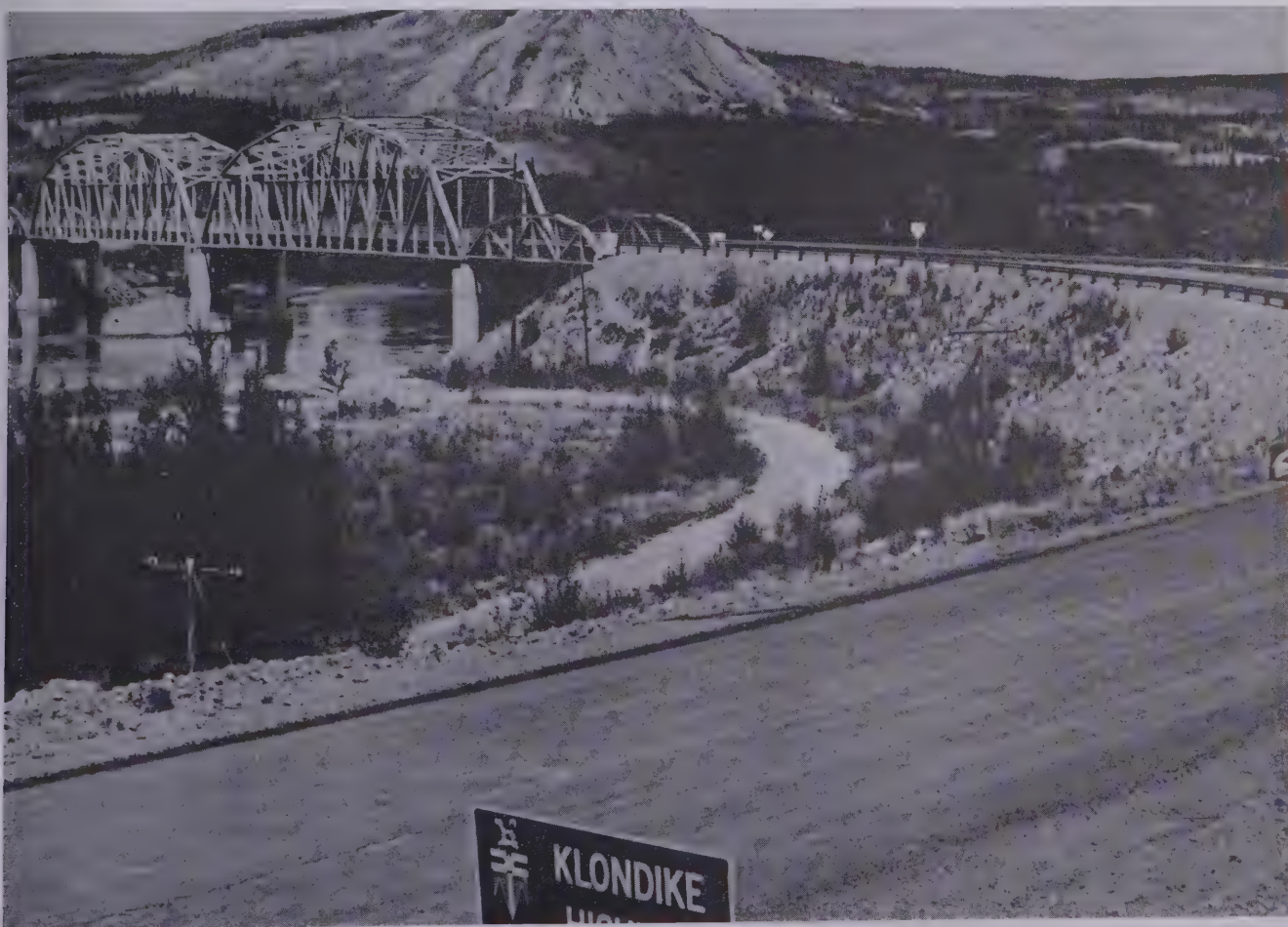
The use of coal as a fuel to provide electricity is purely a matter of economics and availability. It is known that coal-fired thermal plants cost much less than hydro plants of a similar capacity. But coal mining costs have to be paid for by the electricity, just as the investment cost of a hydro plant has to be paid for. It is a matter for economists to show which is cheaper for a plant of a given size. Coal is a viable alternative to hydro elsewhere and may be in the Yukon as well.

The history of Yukon coal use is limited. Most of the data we have was written before 1910. The use of coal in the Yukon has been low. At present only one mine - Tantalus Butte at Carmacks - produces coal shipping 20,000 tons per year to the Anvil mine for heating purposes. Not enough is known about the Yukon's coal resources. The questions that need to be answered are; is there coal? Is it in mineable quantities? Is it mineable? Is it of sufficient quality to be used as a fuel?

Known coal deposits in the Yukon are usually long and narrow and steeply dipping. Apparently they are not suitable for low cost strip mining. If the deposits are large enough they could be mined by underground methods but

their size is not yet known. The quality of the coal is reasonably good. Carmacks coals are bituminous 'B' with a heating value of between 9500 and 13,000 BTU per pound, certainly good enough for a thermal plant. Another quality is that these coals are low in sulphur and less likely to pollute the air or groundwater. Exploration for coal has been slight because industry has been looking for an export commodity - coking coal - and there has been no incentive to explore from the early results.

There are advantages to Yukon coal and a thermal plant that should be considered. A coal mine and plant would use less land area than a dam and reservoir, also the plant would be located above the valleys where land use is concentrated. A second advantage is that the lower capital cost and higher operating cost compared to hydro mean more money accumulating to the Yukon through employment, goods and services. Known possible reserves of coal in the Carmacks area are sufficient for a 20 megawatt thermal plant for 25 years of operation. This estimate and the lack of knowledge about Yukon coal indicate that more study is needed.



### **Tantalus Butte, Carmacks**

*This hill contains the Yukon's only working coal mine. There may be sufficient coal in the area to supply a thermal generator.*

★ Yukon Territorial Government photo ★



# **PANEL DISCUSSION**

## **The Sigma Report and its Implications for the Future**

### **Panelists**

Martyn Williams President, Yukon Conservation Society,  
Chairman, Garth Graham, Yukon Research and De-  
velopment Institute

Richard Lloyd, Yukon Conservation Society

Rob McCandless, Yukon Conservation Society

Dave Mossop, Yukon Game Branch

Flo Whyard M.L.A. (Ind.) Whitehorse West

*The session opened with each panelist giving an opinion of the Sigma Report and its implications, and then passing into an open discussion with the audience. The main points raised by the panelists are given in note form and are not intended to represent quotations. Tape recordings of this session and the other evenings are on file in the Yukon Archives.*

### **Rob McCandless:**

The Sigma Report has estimates of the Yukon's future power needs and using these estimates proposes several power projects for detailed investigation. It is these estimates that are in dispute. The rapid growth in power demand over the past 8 years is due almost entirely to mining and to a lesser extent to an increase in population. The authors of the report assume that this growth will continue. If NCPC continues to supply new mines, a new plant may be necessary. We do not know the terms of the contract between NCPC and Anvil. We should try to obtain this information to prevent a mine - with its limited life - from causing NCPC to destroy a river to provide power for that mine.

### **Richard Lloyd:**

Any forecast of demand can be met by building a plant somewhere in the Yukon. Objections to one site will be met by proposing another site. We must question the need for more power as a first priority. Beyond that the report

does not include estimated costs of environmental damage for each site and is biased as a result. It does not attempt to put forward a serious analysis of our need for power and the price we must pay in environmental considerations. We must try to decide if the Yukon shall become just another industrial area.

### **Dave Mossop:**

The Sigma Report contains too many inaccuracies and omissions to make a serious proposal about a dam. The authors have failed to make a full search of what is known about wildlife. They have overinterpreted their data, they have made statements unsupported by facts and they have not made recommendations about the gaps in our knowledge about wildlife. Yukoners are outstanding both in their appreciation of wildlife recreation and in their utilization of these resources in hunting, trapping and fishing. We should not undertake any power project until studies have been made to a degree comparable to the work done for the proposed Mackenzie Valley pipeline.



**Flo Whyard:**

The only fair way to look at the Sigma Report is to look at the terms of reference. The authors were not asked to recommend a project at this stage, nor were they asked to see if we wanted one. The present use of diesel power is too expensive and it should be replaced by other means. Coal is a serious alternative. We should be wary of the report's cost estimates in 1973 dollars for a 1980 project. An environmental impact study is proposed as a later phase of the planning process, before a decision is made about any site.

**Garth Graham:**

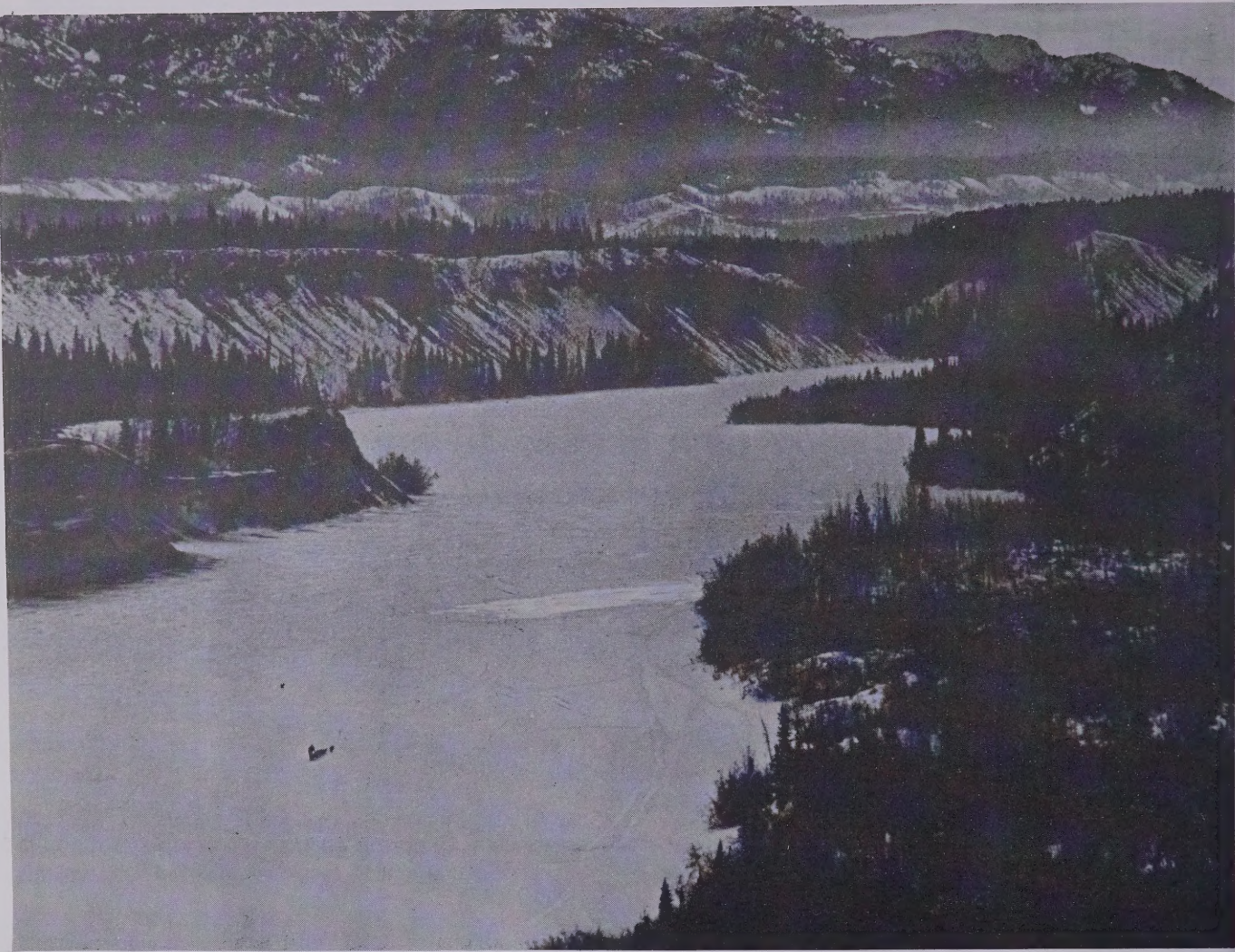
The Sigma Report and the public meetings last December seem to be part of a new approach by government in determining the public's attitude to major projects. In the past conservation groups could only say 'we are concerned', a futile response. Nowadays conservation groups have to propose serious alternatives to the government's plans to be effective. A well-organized group that brings together many viewpoints can cause change in policy.

*The discussion now opened to members of the audience. The points are given below as they were raised and discussed by the audience and the panelists.*

- What is the final bill for the Aishihik plant? If the costs have overrun what will happen with a much larger plant? In the U.S., final costs for some U.S. Army Corps of Engineers dams were never given. There is inadequate cost estimation on projects of this kind.
- The construction by White Pass of a weir at Marsh Lake in 1922 began a gradual decline in the M'Clintock River salmon run, a decline that was made worse by the Whitehorse Rapids dam. Now we are told there will be no salmon on the upper Yukon after 1985.
- The total energy cost of a big project must be weighed against the energy result. Some plants - even the big Syncrude Project - may never recover the energy that was used to build them.
- Even though the people of Canada may put up the money for a plant we will have to pay for it in the electricity we use. We may not be able to afford a new power source.
- The appointment of a Northerner to head NCPC is "Crumbs from the table but at least it's crumbs"
- Some regulation is needed over 'Outside' consultants, either through a review committee or more use of qualified residents or through enforcement of the **Scientists and Explorers Ordinance**. The new D.I.A.N.D. Scientific Research Laboratory may be of some use in co-ordinating research.
- The Sigma Report makes engineering-style estimates

- of cost, but has nothing to indicate that a professional engineer made those estimates. The Yukon Association of Professional Engineers should comment on reports of this kind.
- The wild lands of the Yukon have great value now and this value will increase as more demand is placed on them. New approaches to study should be used to take these changing values into account.
- We may be in a development 'plateau' right now that will allow time for a climate of opinion to appear. We are not as isolated as we might think, people are making decisions about us all the time, outside the Yukon.
- What sort of "constructive recommendations" can you make to NCPC and Sigma Resource Consultants? If a new mine comes along, tell them to generate their own power using diesels.
- Any group concerned with the environment should not react to say, the Sigma Report but should concentrate on articulate, well-researched presentations to agencies such as the Water Board.
- The Yukon population will continue to grow regardless of industrial development. We need more studies of the environment and alternative sources of power. We need to make better use of the power we have now. We can control our growth through other agencies such as CMHC, or through land policies. Given enough time and imagination new alternatives will appear.





### **Yukon River near Whitehorse in winter**

★ Yukon Territorial Government photo ★

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